

# Sugars for Fermentation

## SIMPLE AND REFINED SUGARS

### **Glucose/Dextrose/Corn Sugar**

Glucose is a monosaccharide. This simple sugar is derivable from converted starches such as what happens when mashing malted grain. Sugar processors can make this sugar from a variety of sources - corn (maize), wheat, rice, potatoes, in short, anything with cheap starch can be a input into the process. However if not completely refined down to simple sugars, some of the origin can be discerned. The right handed variation of glucose is called dextrose.

### **Maltose**

A dissacharide made up of two glucose molecules. Completely fermentable. Contributes ~45 points per pound.

### **Fructose/Fruit Sugar**

Another monosaccharide. In all-malt beers, this normally appears as only few percent of the wort. Yeasts will rapidly ferment this but there might be some problems (I can't recall but I seem to remember that Dave Miller's book describes the problem as a "spill over effect" that causes some off-flavors due to the production of different fermentation products.)

Fructose tastes much sweeter than glucose or even the combination of fructose + glucose (= sucrose). That's why big food processing companies use "high fuctose" sugars because they get more bang for the buck by using less of a sweeter tasting sugar. On the other hand, to continue the digression, lots of hard-core CocaCola drinkers like the less sweet sugars since it requires more which makes a thicker, more viscous soft drink.

See the entry for "sucrose" for a description of how the "high fructose" syrup is made. Fructose is also called levulose because that form rotates light in a left handed direction.

### **Sucrose/Table Sugar/Cane Sugar**

Sucrose is a disaccharide composed of one molecule of glucose and one of fructose. More precisely, it is dextrose plus dextrorotary fructose. It must be broken apart before the yeasts can use it. When heated in an acidic solution (such as wort) the sugar is inverted to make D-(+)-glucose and D-(-)-fructose. Yeasts will invert the sucrose if it is not already in that form before using by using invertase. It is derived from sugar beets or sugar cane that are crushed and dissolved in water. The raw syrup is boiled down to concentrate it to a point where some fraction crystallizes. The remaining heavy syrup (see "molasses") is separated from the 95+% pure sugar. The crystals are further processed several times to increase its purity yielding, eventually, the pure white crystals we commonly use. Some other commonly used sugars are also produced during the processing.

A complaint in the early days of modern homebrewing was that using table sugar in beer-making resulted in a "cidery" beer.

The symptoms were that a beer made with table sugar that was added to the boil produced a cidery flavor that faded after several weeks in the bottle. Therefore the rule of thumb became 'avoid all table sugar'. While this is still a good idea when using malt extract, this old-(ale)wives tale is misleading. That defect most likely came from poor yeast due to a too low pitch, insufficient free-available-nitrogen, or a lack of other necessary yeast building materials in the wort. Table sugar can be used in small amounts with no harm and it is certainly cheaper to use for priming. This simple colorless sugar will lighten the body of a beer since it can be completely fermented. It also lightens the beer color.

## SYRUPS AND PROCESSED SUGARS

### **Invert Sugar**

This is simply sucrose (aka, table sugar) that has been subjected to "hydrolysis" which breaks the disaccharide sucrose into its constituent sugars. The fructose is inverted (made into its optical isomer). The inversion process involves adding acid and is usually done at high temperatures to speed up the process. Alternately, the invertase enzyme can be used.

### **Raw Sugar**

The only unrefined sugar available to the average consumer seems to be Sucanat, an evaporated sugar cane syrup. Raw beet sugar is reputed to be unsavory. It may be possible in some markets to get other raw sugars (e.g., in Hawaii, pineapple sugar may be sometimes found).

### **Demerara/Turbinado**

This is crystalizable sugar from the first step of refinement. It has a tan to brown color from the residual impurities. Some food faddists attribute beneficial results from using this but unless a lot is consumed, the potential benefits are very low. Demerara is the UK term; turbinado the US (and Spanish language?) term. Demerara is usually a dark brown shade while turbinado is lighter, more of a tan or taupe color. It is 98% sugar with some residual proteins and unfermentable carbohydrates present.

### **Molasses/Treacle**

This is the residue of the sugar after the crystalized portion has been removed. The choice of names for this sugar syrup seem to reflect regional language preferences rather than any major differences. In the US, "molasses" is the preferred term while in the UK and ex-colonies, "treacle" is used. Regular treacle is an inverted sugar produced from the residue of refinement. The acid treatment darkens it. Molasses is filtered and may have a sulfur compound added to sterilize and stabilize it. "Black treacle" is roughly the same flavor as "blackstrap molasses" however treacle may be produced differently. While there are differences between the differently named syrups, there is also a wide variability within syrups of the same name! Find one company's product you like since that may be the only level of consistency obtainable. Light molasses is roughly 90% sugar. Blackstrap is about 50% sugar and has a wide variety of crud remaining.

## **Golden Syrup**

Like molasses, this is a syrup that remains after the crystallizable sugars have been removed. However, since the syrup is removed later in the refinement process, it does not have as heavy a taste or color as molasses. Lyle & Tate's product is derived from cane sugar. The syrup has been inverted using a strong acid (hydrochloric acid, I think) and then counter-acted by the addition of base (NaOH) after a short time. Some of the golden color is from the acid treatment. A salty taste comes from the acid + base combining to form NaCl.

## **Brown Sugar**

In the US, this is just refined sugar with some molasses added back in. The US food law says that only refined sugar (no raw components) can be sold with this name. This law may actually have more to do with enforcing a similar taste for both sugar beets and sugar cane since the beets, when un-refined, have a poorer taste than cane. [ Sidenote: with the possible elimination of sugar support prices in the US, this category may change...] Compare this to Piloncillo (Mexican brown sugar) which is a semi-refined granulated sugar.

## **Candy Sugar/Belgium Candy Sugar/Sucre Candi/Candij Sugar**

This sugar is commonly used in Belgium beers. It comes in several colors - light to dark. When added to beer, it thins out the high gravity beers and contributes color and, for the dark version, some residual caramel flavors. Candy sugar is sucrose. Its production is the same as for rock candy (i.e., slow crystallization of a concentrated sugar solution) made from straight sucrose so a brewer should be able to substitute regular sugar for it. Dark candy sugar has been caramelized before it is crystalized.

## **Corn Syrup**

Basically glucose with water. May have maltose. Beware about buying the typical grocery store version because it might have some vanillin/vanilla as a flavoring. Additionally, some brands have a preservative that could affect fermentation. Dark corn syrup is just the regular syrup with some coloring. Use wherever you would use straight glucose/dextrose such as priming.

## **Honey**

Honey is a complex mix of sugars but it is mainly glucose (roughly 30%, by weight) and fructose (40%) in invert form; the bees supply the invertase, which is the enzyme that inverts the fructose. Honey's make-up is not consistent - it varies by source, season, region, and producer. It is about 75% fermentable sugar; the remainder is water, proteins, some minerals, etc.

### **Jaggery**

Unrefined- or semi-refined date sugar.

### **Lactose/Milk Sugar**

An unfermentable sugar (at least by ordinary beer yeasts) often used to boost the residual sweetness as in "milk stouts".

### **Maltose Syrup**

Some UK recipes call for this. To make it, you mix glucose and a dextrin powder in a 4:1 ratio. The 20% dextrin will remain unfermented and therefore lends body and mouthfeel that a pure sugar syrup would not.